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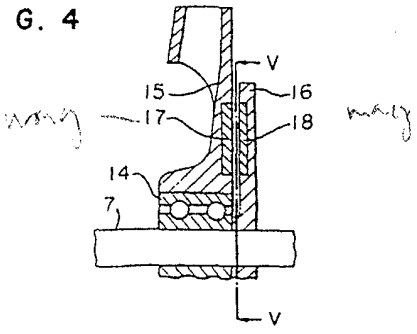
(54) **Rotating electric machinery.**

(57) A rotating electric machinery comprises a stator; a rotor which is fixed to a rotor shaft (7) and is driven by said motor; a fan (15) which is rotatably connected through a bearing (14) to said rotor to feed air in a predetermined direction; and at least one pair of magnets (17, 18) having a predetermined magnetic force which are fixed on either said rotor or said fan and a magnetic substance (17, 18) having a predetermined coercive force which is fixed on said fan or on said rotor to face said magnet with a desired gap.

FIG. 4



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BACKGROUND OF THE INVENTION:

FIELD OF THE INVENTION:

The present invention relates to a rotating electric machinery which reduces noise.

DESCRIPTION OF THE PRIOR ART:

Heretofore, a rotating electric machinery used for an electric car such as a traction motor has a structure shown in Figure 1, wherein the reference numeral (1) designates a yoke; (2) designates a suction hole formed on the yoke (1); (3) designates an exhaust hole formed on the yoke (1); (4) and (5) respectively designate end brackets formed at each end of the yoke (1); (6) designates a bearing formed on each end bracket (4), (5); (7) designates a shaft supported by the bearing (6); (8) designates a rotor consisting of an iron core, a coil and a commutator connected to a spider (9); (10) designates an air-passage formed in the rotor (8) and the rotor spider (9); (11) designates a fan fixed on the shaft (7); (12) designates a brush device equipped with the end bracket (4) to contact with the commutator; and (13) designates a stator consisting of an iron core formed on the yoke (1) and a coil.

In the motor having the aforementioned structure, the fan (11) is driven depending upon the rotation of the rotor (8) whereby the air sucked from the air suction hole (2) is passed through the space between the rotor (8) and the stator (13) and the air passage (10) as shown by the broken arrow line to cool the heated rotor (8) and

the stator (13). The air heated by the cooling said rotor and stator, is discharged through the exhaust hole (3) by the rotating fan (11).

The traction motor for an electric car is usually driven in a range of 0 to 4000 r.p.m.. In the conventional traction motor, the fan (11) is fixed on the shaft (7). Therefore, the fan (11) rotates at the same revolving speed as that of the traction motor as shown by the broken line in Figure 2. The noise caused in the revolving of the traction motor increases depending upon an increase of the revolving speed as shown by the broken line in Figure 3. The main factor of the noise is considered as an air blow sound caused by the fan (11). In the conventional traction motor, the following relation is given;

$$\text{Noise of motor} \propto \text{revolving speed of fan} = \text{revolving speed of motor}$$

The conventional traction motor has the disadvantage that the noise increases depending upon the increase of the revolving speed.

SUMMARY OF THE INVENTION:

It is an object of the present invention to overcome the aforementioned disadvantage and to provide a rotating electric machinery which has less noise at high revolving speed.

The foregoing and other objects of the present invention have been attained by providing a rotating electric machinery in which a fan is connected through a bearing to a shaft of a rotor; and at least one pair of magnets having a predetermined magnetic force and a magnetic substance having a predetermined coercive force given by magnetization resulted by the magnet.

BRIEF DESCRIPTION OF THE DRAWINGS:

Figure 1 is a front view of a rotating electric machinery;

Figure 2 is a graph showing the relation of the revolving speed of the traction motor and a fan;

Figure 3 is a graph showing the relation of the revolving speed of the traction motor and the noise of the motor;

Figure 4 is a front view of one embodiment of a rotating electric machinery of the present invention;

Figure 5 is a view of a partial arrangement;

Figure 6 is a vector of the magnet and the magnetic substance;

Figures 7 and 8 are respectively front view of the other embodiments of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS:

Referring to the drawings, the embodiments of the present invention will be illustrated.

In Figure 4, the reference (7) designates a shaft of the rotor; (14) designate a ball bearing fitted on the shaft (7); (15) designates a fan which is rotatably connected through the ball bearing (14) to the shaft (7); (16) designates a rotating support member fitted to the shaft (7) to face the fan (15) with a desired gap; (17) designates a magnet fitted on a surface which is substantially perpendicular to the axis (7) of the fan (15); and plural pairs of magnets (17) of N- and S-magnetic poles as shown in Figure 5. A magnetic substance (18)

is fitted to a rotating support member (16) to face the magnet (17) and is made of a substance having a predetermined coercive force induced by the magnet in the polarity opposite to the polarity of the magnet (17) on the surface in proportional to a corresponding area to the magnet (17) as shown in Figure 6.

In the embodiment having the aforementioned structure, S-pole is induced on the magnetic substance (18) facing to N-pole of the magnet (17) as shown in Figure 6 under the condition shown in Figure 4.

When the magnetic substance (18) shifts for Δx to the magnet (17) under the condition in the case of the magnetic substance (18) made of a magnetic material having a predetermined coercive force, the S pole remains at the position to apply the inclined attractive force between the magnet (17) and the magnetic substance shown in Figure 6. The attractive force applies to the magnet (17) as a tension (P). The component of force (P_2) of the tension (P) in the tangential direction is applied as the torque for revolving the magnet (17). The torque (P_2) increases depending upon an increase of the coercive force of the magnetic substance.

In Figure 6, $P=P_1$, and $P_2=0$ in the stop of the motor, The tension (P) is applied between the magnetic substance (18) having a coercive force and the magnet (17) by the rotation of the motor and the fan (15) is rotated by the torque (P_2) as the component of force given by the tension (P). When the torque (P_F) required for the rotation of the fan (15) is given by increasing the revolving speed of the motor reaches to $P_2 < P_F$, the slip of the fan (15) is resulted. Therefore, even though the revolving speed of the motor increases, the revolving speed of the fan (15) is limited to the maximum revolving speed given by

the torque (P_2).

When the torque P_F 2000 for the revolving speed of the fan (15) at 2000 r.p.m. is set to $P_2=P_F$ 2000, the revolving speed of the fan (15) increases to 2000 r.p.m., the same as that of the motor, however, the fan (15) is driven at the constant revolving speed of 2000 r.p.m. even though the revolving speed of the motor increases over 2000 r.p.m.. The revolving speed of the fan (15) is set by the torque (P_2) controlled by the magnetic force of the magnet (17) and the adjustment of the gap between the magnet (17) and the magnetic substance (18). Therefore, the noise (dB) of the motor increases depending upon an increase of the revolving speed of the fan (15) to reach 2000 r.p.m. and the noise level is kept in substantially constant even though the revolving speed of the motor increases over 2000 r.p.m..

Figures 7 and 8 show the other embodiments of the present invention.

In the embodiment shown in Figure 7, the magnetic substance (18) is fitted to the rotor spider (9) to face the magnet (17) fitted to the fan (15) whereby the extension of the motor in the axial direction is prevented together with the same effects of the aforementioned embodiment.

In the embodiment shown in Figure 8, the magnets (17) and the magnetic substance (18) are arranged to face each other in the circumferencial direction of the rotation of the rotor (8) whereby the same effect of the aforementioned embodiment is attained.

In the embodiments, the magnets are fitted to the fan, and the magnetic substance is fitted to the rotor. However, the same effects of the embodiments are attained by fitting the magnets and the magnetic

substance to the other ones of the rotor and the fan.

In accordance with the present invention, the fan is connected through the bearing to the shaft and at least one pair of magnets having a predetermined magnetic force and the magnetic substance having a predetermined coercive factor magnetized by the facing magnet, are respectively fitted to the rotor and the fan to face each other, whereby the fan is driven by the predetermined torque resulsted by the rotation of the rotor. The torque of the fan is not increased over a predetermined level. Even though the revolving speed of the motor increases, the noise level is maintained to prevent the noise at high speed range of the revolving speed of the motor.

CLAIMS:

1) A rotating electric machinery which comprises a stator; a rotor which is fixed to a rotor shaft and is driven by function of said stator, a fan which is rotatably connected through a bearing to said rotor to feed air in a predetermined direction; and at least one pair of magnets having a predetermined magnetic force which are fixed on either said rotor or said fan and a magnetic substance having a predetermined coercive force which is fixed on said fan or on said rotor to face said magnet with a desired gap.

2) The rotating electric machinery according to Claim 1 wherein said rotor is an armature rotor having a rotor spider; and said magnet or magnetic substance is fixed to said rotor spider.

3) The rotating electric machinery according to Claim 1 wherein said rotor is a rotating support member mounted on the rotor shaft, and said magnet or magnetic substance is fixed to said rotating support member.

4) The rotating electric machinery according to Claim 1 wherein said magnet faces said magnetic substance on an axis substantially perpendicular to the axis of said rotor.

5) The rotating electric machinery according to Claim 1 wherein said magnet faces said magnetic substance on a circumferencial

surface of said rotor in the radial direction.

6) The rotating electric machinery according to Claim 1 which is a traction motor.

FIG. 1

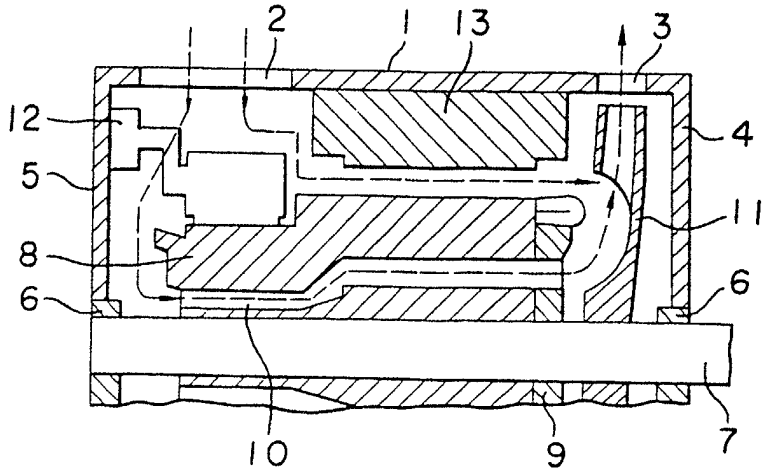


FIG. 2

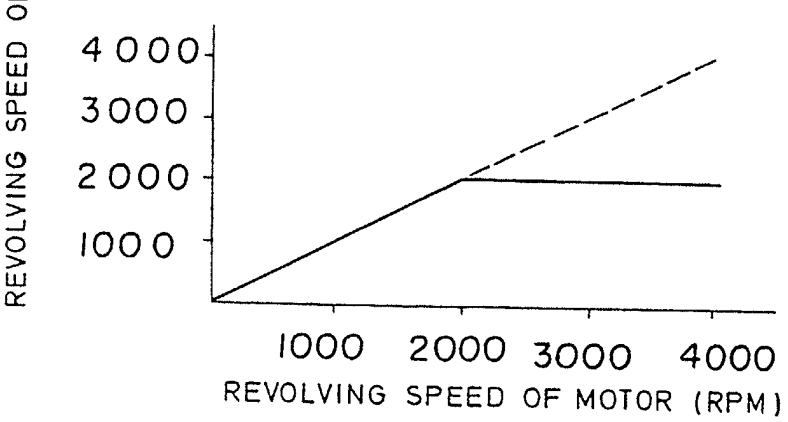


FIG. 3

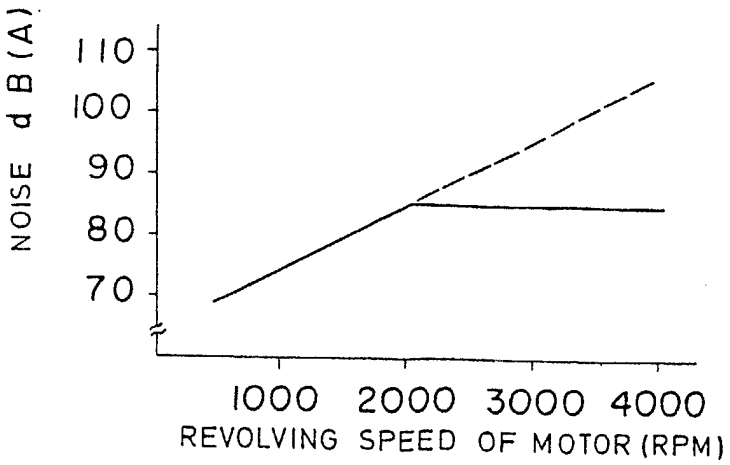


FIG. 4

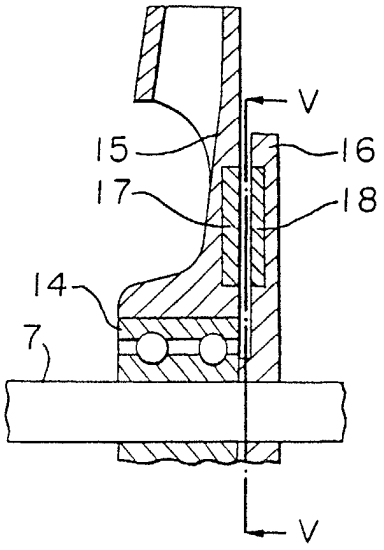


FIG. 5

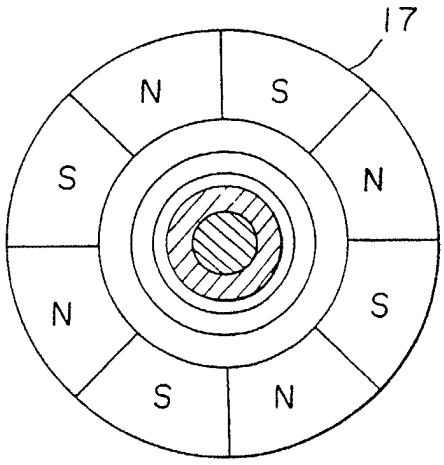


FIG. 6

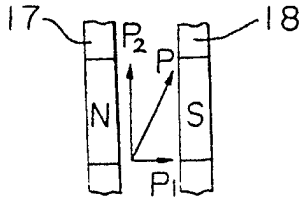


FIG. 7

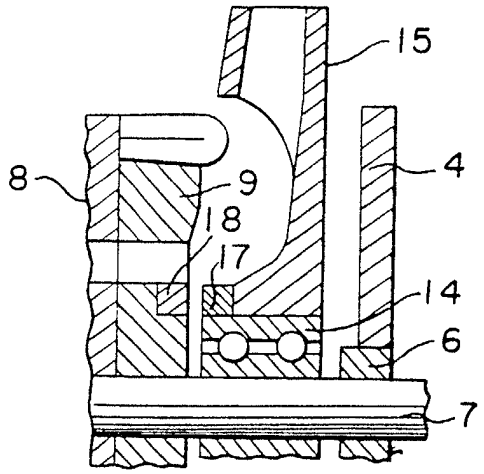
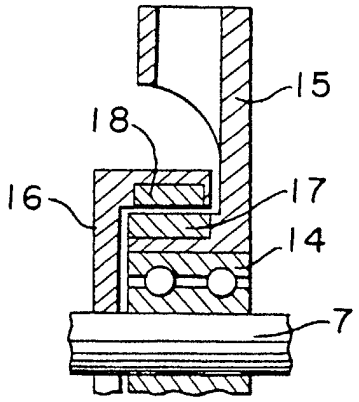


FIG. 8



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EUROPEAN SEARCH REPORT

Application number
EP 81 10 8148.8

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	DE - A - 1 563 049 (STEWART-WARNER) * fig. 1,3 * & GB - A - 1 155 131 --	1	H 02 K 9/06 F 16 D 27/01
	DE - A1 - 2 653 459 (H.-D. RASCHKE) * claim 1; fig. 1 * --	1	
	FR - A - 2 355 205 (AEROWATT) * claim 5; fig. 1 * --	1,3,5	TECHNICAL FIELDS SEARCHED (Int. Cl.³)
	DE - A1 - 2 821 973 (VIBRAC) * fig. 1, 10 to 12 * --	3,4,5	F 16 D 27/00 H 02 K 9/00
A	GB - A - 1 268 444 (SOCIETE D'ETUDES ET DE RECHERCHES MAGNETIQUES) * fig. 1 * --		
A	US - A - 3 456 141 (T.H. BURGESS) * fig. 1 * --		
A	DE - A - 1 613 060 (CONGENIA) * fig. 1 * --		CATEGORY OF CITED DOCUMENTS
A	DE - B - 1 188 191 (DEUTSCHE EDELSTAHL-WERKE) * fig. 1 *		X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
X	The present search report has been drawn up for all claims		&: member of the same patent family, corresponding document

Place of search	Date of completion of the search	Examiner
Berlin	18-12-1981	BREUSING

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